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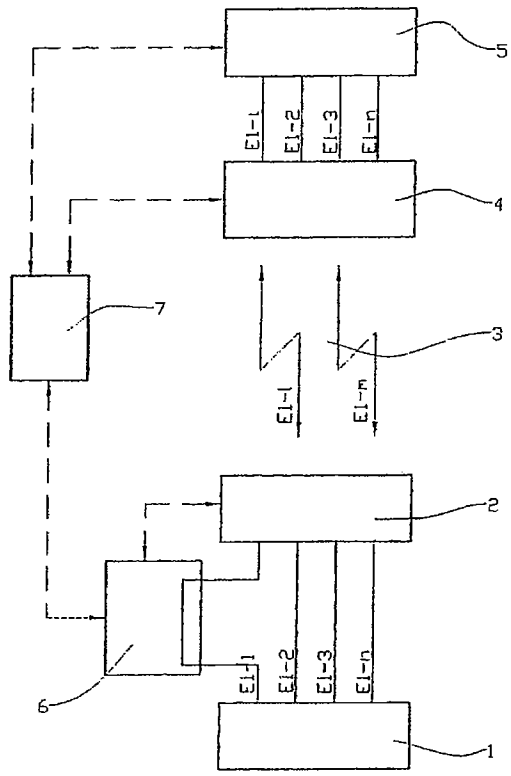
(54) Title: METHOD FOR REDUCING THE TIME DELAY IN A TELEPHONE SYSTEM



(57) Abstract: A method of switching a speech channel in a mobile telephone system comprising an interface between a Base Station System (BSS) (1) communicating with a Mobile Switching Center (MSC) (5) via a transmission connection (3), where the speech channels of an originating subscriber (8) and a dialled-up subscriber (9), both of whom are located on the BSS (1) side of the transmission connection (3), are connected in a local switcher (2).

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METHOD FOR REDUCING THE TIME DELAY IN A TELEPHONE SYSTEM

This invention regards a method for reducing the time delay in a telephone system. More particularly, it regards a method for reducing the audible time delay that occurs when the signals are transmitted e.g. via a satellite channel. In the following, reference is made, for illustrative purposes, to a satellite connection or channel. Satellite connection is here taken to mean an entire satellite system comprising multiplexers (MUX), antennas and satellite.

In the following, reference is made, for illustrative purposes, to a GSM system (GSM - Global System for Mobile Communication) which employs a so-called A-interface between a Base Station System (BSS) and a Mobile Service Switching Centre (MSC). In conventional mobile telephony all calls are connected in the Mobile Service Switching Centre.

Under normal circumstances such a solution is acceptable, but when the BSS and the MSC communicates e.g. via a satellite connection, an audible time delay in the order of 0.5 seconds will arise.

Typically, this is a problem when the BSS is located on a ship and the MSC is on shore.

The time delay doubles when both parties are on the same side of the satellite connection, as the signals must then first be sent via the satellite connection to the MSC and then return to the BSS via the same satellite connection.

The object of the invention is to remedy the disadvantages of prior art.

The object is achieved in accordance with the invention, by the characteristics stated in the description below and in the following claims.

According to a standardized protocol for telephone systems of this type, signalling and speech are separated into two separate channels, a signalling channel and a speech channel. Thus it is possible to process data transmitted via the speech channel without interfering with the signalling channel.

When two persons on the same side of a satellite connection call each other, the speech channels can be connected by use of a local change-over switch or switcher, while the signalling channel is transmitted to the MSC via the satellite connection. Thus the speech channel is not transmitted via the satellite connection and therefore is not subject to said time delay.

Monitoring and analysis of the data stream in the signalling channel between the BSS and the MSC makes it possible to extract any data indicating that a call should be switched locally, whereupon the respective speech channels are connected locally.

A further advantageous feature of the invention is that the transmission capability requirement of the satellite connection is reduced.

An A-interface (interface) for communication between a BSS and a MSC comprises a number of TDM (time-division multiplex) connections. By concentrating the number of calls routed via the satellite connection to a smaller number of TDM links at the BSS in order then to expand these concentrated TDM links to the initial number at the MSC, it becomes possible to save transmission capability in the satellite connection. Thus, TDM time slots not transmitted to the MSC can be used for local calls.

In a conventional mobile telecommunication system the capacity is determined by the total number of TDM time slots and links between the BSS and the MSC.

In those cases where all TDM time slots in said concentrated transmission connection are being used, the conventional mobile telecommunication system will attempt to set up more calls if there are any free TDM time slots for local calls. The reason for this is that a conventional MSC will not be able to keep track of which calls are local and which are long distance calls, and in consequence, nor will it know the capacity situation in the transmission connection.

The invention comprises a method of preventing the MSC from attempting to set up further calls when the capacity of the transmission connection is fully utilised.

The following describes a non-limiting example of a preferred method illustrated in the accompanying drawings, in which:

Figure 1 shows the principal components of a telephone system according to the invention;

Figure 2 shows the transmission paths of the signalling and speech channels according to prior art; and

Figure 3 shows the transmission paths of the signalling and speech channels according to the invention, the transmission path of the signalling channel being illustrated by a broken line.

In the drawings, reference number 1 denotes a BSS of a type that is known *per se*. The BSS 1 communicates with a local change-over switch or switcher 2 via a plurality of channels E1-1 to E1-n, where n is a selected number.

The local switcher 2 communicates via a transmission system 3, here in the form of satellite communication, with a remote switcher 4 via a plurality of channels E1-1 to E1-m, where 1 and m are selected numbers.

The remote switcher 4 communicates via a plurality of channels E1-1 to E1-n with an MSC 5 of a type that is known *per se*. The channels E1-1- to E1-n between the remote switcher 4 and the MSC 5 correspond to the channels E1-1 to E1-n between the BSS 1 and the local switcher 2.

A TDM time slot monitor, decoder and analyser 6, hereinafter denoted TDM analyzer or optionally analyzer, is connected to the channels between the BSS 1 and the local switcher 2. In Figure 1 this is illustrated by channel E1-1 being connected to the TDM analyzer 6.

The TDM analyzer 6 communicates with the local switcher 2 and with the remote switcher 4 and the MSC 5 by means of a TCP/IP

(Transmission Control Protocol/Internet Protocol) connection/network 7.

The TDM analyzer 6 constructs a local database of so-called IMSI (International Mobile Subscriber Identity) and MD-ISDN (Mobile Station - Integrated Services Digital Network) number for each mobile telephone associated with the BSS 1.

The IMSI number is read from the signalling message 'location_updating_accept', while MS-ISDN is obtained from the MSC 5 by making an inquiry using the IMSI number as a reference.

Then the TDM analyzer 6 establishes a temporary list of all subscribers attempting to set up calls, hereinafter denoted A-subscribers 8, in the MSC 5.

The following A-interface messages are monitored in order to obtain the required information, the nature of the information being indicated in brackets:

4. Cm_service_request (A-IMSI)

5. Connection_confirmed (logical signalling link Id)

6. Setup (MS-ISDN for B-subscriber)

7. Assigment_request (information regarding which time slot is being used).

The messages are obtained from the protocols SCCP (Signalling Connection Control Part), DTAP (Direct Transfer Application Part), BSSMAP (Base Station System Management Application Part) in the A-interface.

A temporary listing is stored in the MSC 5, which includes all mobile users to whom a dial-up is attempted, at all times, and these users/subscribers are hereinafter denoted B-subscribers 9.

The following A-interface messages are monitored in order to obtain the required information, the nature of the information being indicated in brackets:

8. Paging_response (B-IMSI)

9. Connection_confirmed (logical signalling link Id)

10. Assignment_request (information regarding which time slot is being used).

11. Connect_acknowledge (used as time of concentration for external calls).

When the A-subscriber receives the A-interface message 'connect_ack' the TDM analyzer 6 will make an inquiry for the B-MS-ISDN number in the above mentioned subscriber database and then check whether the resulting B-IMSI number is on the list of B-subscribers to whom a dial-up is being attempted. If the number is there, the corresponding TDM time slots are cross-connected in the local switcher 2.

If calls are not to be cross-connected locally, e.g. when the A- and B-subscribers 8, 9 are in different BSS's 1, collected TDM time link information is used to initiate the desired concentration of the TDM time links.

All connections of calls and concentrations of TDM time links are controlled by the TDM analyzer 6. TDM time slot informa-

tion for the call in question is used to initiate switching of TDM time slots between the TDM time links on the BSS 1 and MSC 5 side of the local switcher 2 or the remote switcher 4 respectively, and the TDM links transmitted via the satellite connection 3.

Figure 1 shows an example in which four TDM-links are concentrated down to two TDM-links. Obviously other constellations are possible.

The TDM analyzer 6 stores and maintains a list of all calls switched through the local switcher 2 and the remote switcher 4 at all times. When a call is terminated, i.e. the A-interface message 'released' is read from the signalling channel for an active call, the TDM analyzer 6 will notify the local switcher 2 and the remote switcher 4 to break the connections for the call in question.

The relaying of information between the TDM analyzer 6 and the local switcher 2 takes place via a normal TCP/IP network. Likewise, the remote switcher 4 receives information from the TDM analyzer 6 in order to extract the TDM links from the satellite connection 3 to the total number of TDM links in the system in the correct manner.

The TDM analyzer 6 is arranged so as to keep track of the status of the capacity of the satellite connection 3 and prevent further calls from being set up in the MSC 5 when all available transmission capacity is in use. This is done by using the TCP/IP network 7.